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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/705,231	11/12/2003	Duan-Fu Stephen Hsu	55071-311	3609

7590 11/17/2005

MCDERMOTT, WILL & EMERY
600 13th Street, N.W.
Washington, DC 20005-3096

EXAMINER	
ROSASCO, STEPHEN D	
ART UNIT	**PAPER NUMBER**
1756	

DATE MAILED: 11/17/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/705,231	HSU ET AL.	
	Examiner	Art Unit	
	Stephen Rosasco	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 October 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-24* is/are pending in the application.

4a) Of the above claim(s) *13-18* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12 and 19-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *12 November 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *6/27/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Detailed Action

Applicant's election without traverse of Group I (claims 1-12 and 19-24) in the reply filed on 10/28/05 is acknowledged.

The disclosure is objected to because of the following informalities: page 5, line

Page 6, line 1, "cuts-outs".

Appropriate correction is required.

Claims are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claim 1 is rejected under 35 U.S.C. 102(e) as being anticipated by Robles et al. (US 2004/0005089).

Robles et al. teach a method for correcting an integrated device layout, comprising: reading at least a portion of the layout, said layout portion containing at least one edge fragment; using a simulator to predict a property associated with said edge fragment; storing the predicted property as a tag associated with the edge fragment; and applying a

rule for modifying the layout, with the parameters for the application of the rule determined from the values of the tag associated with the edge fragment.

And also see section [0019] For dipole illumination, or off-axis illumination, edges are often classified based on orientation. For example, di-pole illumination often uses two masks. One mask is illuminated with a horizontal di-pole and one mask is illuminated with a vertical di-pole. Since edges that are oriented perpendicular to the orientation of the di-pole have sharper intensity profiles and resolve more clearly, edges are usually classified as either horizontal or vertical and assigned to the appropriate mask. The corresponding space in the opposite mask includes a shield to prevent the area from being exposed by the other mask.

Claim 7-12 and 19-24 are rejected under 35 U.S.C. 102(e) as being anticipated by Capodieci et al. (6,553,562) or Van Den Broeke et al. (6,851,103).

The applicant has cited these references on an IDS. The references both teach the apparatus and computer design capability for generating the masks for the method of the claimed invention.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-12 and 19-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Capodieci et al. (6,553,562) or Van Den Broeke et al. (6,851,103) in view of Toublan et al. (6,807,662).

The claimed invention is directed to a method of generating complementary masks for use in a multiple-exposure lithographic imaging process. The method includes the steps of: identifying a target pattern having a plurality of features comprising horizontal and vertical edges; generating a horizontal mask based on the target pattern.

The applicant discusses the limitations of the prior art in that utilizing known techniques such as the one disclosed in the flowchart of FIG. 2, it is sometimes difficult to provide proper shielding for complex structures, such as, "jogs" (i.e., short changes in either the vertical or horizontal direction, for example, a short vertical step, between two long horizontal lines), short "S" urns and/or U-shaped patterns in the design. Moreover, it is sometimes difficult to determine whether or not a given structure of the target design should be treated as a horizontal structure or a vertical structure when initially generating the horizontal and vertical masks.

The claimed invention uses a simplified model-based procedure for generating the horizontal and vertical masks from the target design instead of a complicated hand-crafted rule-based decomposition flow. The known rule-based method illustrated in FIG. 2 requires the generation of a dedicated rule for each and every kind of feature to be printed. Thus, for any practical design, the set of rules that must be generated is prohibitively large. In the method here there is no need to build a library of rules.

The starting point for both the horizontal mask and the vertical mask is the target design. Then, in the horizontal mask, the vertical edges in the target design have shielding applied thereto, and in the vertical mask, the horizontal edges in the target design have shielding applied thereto. The amount of shielding to be applied is determined utilizing the OPC model based on for example, an aerial image or an empirical model.

Capodieci et al. teach a method of generating complementary masks for use in a multiple-exposure lithographic imaging process, said method comprising the steps of: identifying horizontal critical features from a plurality of features forming a layout, identifying vertical critical features from said plurality of features, said vertical critical features extending in a direction orthogonal to said horizontal critical features, identifying interconnection areas, said interconnection areas comprising areas in which one of said horizontal critical features contacts another feature of said layout, and/or areas in which one of said vertical features contacts another feature of said layout, defining a set of primary parameters on the basis of the proximity of said plurality of features relative to one another, generating an edge modification plan for each interconnection area based on said primary parameters, generating a first shielding plan for said horizontal critical features on the basis of said primary parameters, generating a second shielding plan for said vertical critical features on the basis of said primary parameters, generating a first mask by compiling said horizontal critical features, said second shield plan for said vertical critical features and said interconnection areas containing a horizontal critical feature modified by said edge modification plan, and generating a second mask by compiling said vertical critical features, said first shield plan for said horizontal critical features and said

interconnection areas containing a vertical critical feature modified by said edge modification plan.

The teachings of Capodieci et al. or Van Den Broeke et al. differ from those of the applicant in that the applicant teaches performing a shielding step in which at least one of the vertical edges of the plurality of features in the target pattern is replaced by a shield in the horizontal mask, and in which at least one of the horizontal edges of the plurality of features in the target pattern is replaced by a shield in the vertical mask, said shields having a width which is greater that the width of the corresponding feature in the target pattern.

Toublan et al. teach (see claims) a set of masks with definitions created by reading at least a portion of an initial layout of an integrated device layer, identifying two or more target features within the initial layout that are positioned at a distance from each other that is below a limit associated with an isolated pattern, creating a first revised layout definition for a first mask, the first revised layout definition including the two or more target features surrounded by clear areas inside dark-field content, and creating a second revised layout definition for a second mask, the second revised layout definition including one or more dark features inside bright-field content, wherein the one or more dark features, when used in a multiple exposure fabrication process, will overlap the two or more target features and at least a portion of the corresponding clear areas.

It would have been obvious to one having ordinary skill in the art to take the teachings of Capodieci et al. or Van Den Broeke et al. and combine them with the teachings of Toublan et al. in order to make the claimed invention because it is known in the art that the use of multiple masks usually entails the overlapping of a prominent feature in one

direction with a prominent feature in another direction to form a combined result that cancels or blocks out the feature in the other direction.

Conclusion

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Stephen Rosasco whose telephone number is (571) 272-1389. The Examiner can normally be reached Monday-Friday, from 8:00 AM to 4:30 PM. The Examiner's supervisor, Mark Huff, can be reached on (571) 272-1385. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

S. Rosasco
Primary Examiner
Art Unit 1756

S.Rosasco
11/14/05